

# Aeronautical Systems Center

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*Birthplace, Home and Future of Aerospace*



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## **Low VOC, Plural Component Spray (PCS) Coatings Program**

7 May 2009

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Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>07 MAY 2009</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2009 to 00-00-2009</b>	
4. TITLE AND SUBTITLE <b>Low VOC, Plural Component Spray (PCS) Coatings Program</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Science Applications International Corp,5100 Springfield Street,Dayton ,OH,45431</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>Presented at the NDIA Environment, Energy Security &amp; Sustainability (E2S2) Symposium &amp; Exhibition held 4-7 May 2009 in Denver, CO.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>33</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			



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# Presentation Overview



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- **Program Organization**
- **Issues**
- **PCS Program Objectives**
- **Technical Approach**
- **Technical Progress**



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# Program Organization

Issues

PCS Program Objectives

Technical Approach

Technical Progress



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# Program Organization



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**Client/Funding**

**ASC/ENVV**

**Contracting Agency**

**AFCEE**

**Prime Contractor**

**SAIC**

**Subcontractor**

**Raytheon MS**



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# Program Organization

# **Issues**

## PCS Program Objectives

## Technical Approach

## Technical Progress



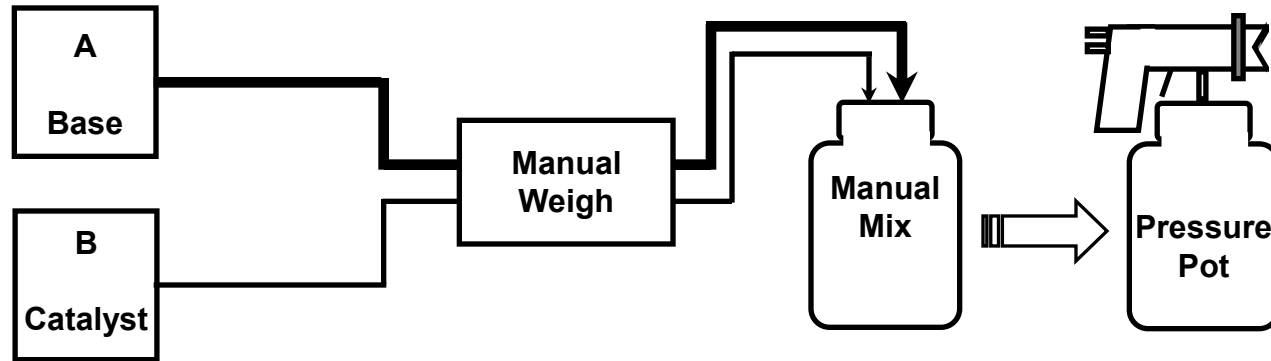
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# Batch Application Method

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## Ad-Mixed Batch



### Drawbacks

- Manual proportioning
- Not quick cure compatible
- Pot-life limitations with ad-mixed material
- Large volumes of paint and solvent waste



# Aerospace Coating Issues



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- **Time and labor intensive**
  - Large required coating thickness
  - Wet mils per pass limitations
  - Long dwell time between passes
  - Time to topcoat limited by slow cure
- **High VOC content**
  - Above targeted VOC goal
  - Costly permitting, monitoring, and controlling





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# Environmental Impact

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- VOC flash-off contributes to overall facility allotment
- Cleaning generates large volumes of hazardous waste
- Generated waste must be disposed of
- VOC monitoring and health screening burden





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Program Organization  
Issues

# **PCS Program Objectives**

Technical Approach  
Technical Progress



# Program Objectives



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- **Reduce VOC content**
  - Objective: 0 g/L; Threshold: 150 g/L
- **Reduce overall production flow time**
  - Increased build rate
  - Decreased cure time
- **Reduce waste generation**
  - Unused coating
  - Cleaning solvent
- **Support follow-on efforts**
  - Collect remaining cost benefit data
  - Prepare for full-scale validation



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# Coating Properties

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Performance Measure	Objective
VOC Content (g/L)	0
Cure Time (hr)	66% of Baseline
Build Rate (wet mils/pass)	$\geq$ Baseline
Time Between Passes (min)	$\leq$ Baseline
Coating Waste Generated (gal)	50% of Baseline
Cleaning Solvent Used (gal)	50% of Baseline
Occupational Health Risk	No Increased Risk



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# Expected Program Benefits



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Benefit	Result	Impact
Reduced VOC content	Reduced facility VOC emissions	<ul style="list-style-type: none"><li>• Decreased permitting costs</li><li>• Decreased monitoring costs</li><li>• Decreased controlling costs</li></ul>
Plural Component Design	Decreased coating and solvent waste	<ul style="list-style-type: none"><li>• Decreased material usage</li><li>• Decreased material cost</li><li>• Decreased labor hours for equipment clean-up</li></ul>
	Decreased hazardous waste generation	<ul style="list-style-type: none"><li>• Decreased hazardous waste storage and disposal costs</li><li>• Decreased health screening costs</li></ul>
Increased build rate	Decreased application time	<ul style="list-style-type: none"><li>• Decreased application labor hours</li></ul>
Improved cure package	Decreased time for full cure	<ul style="list-style-type: none"><li>• Decreased production flow time</li></ul>



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Program Organization  
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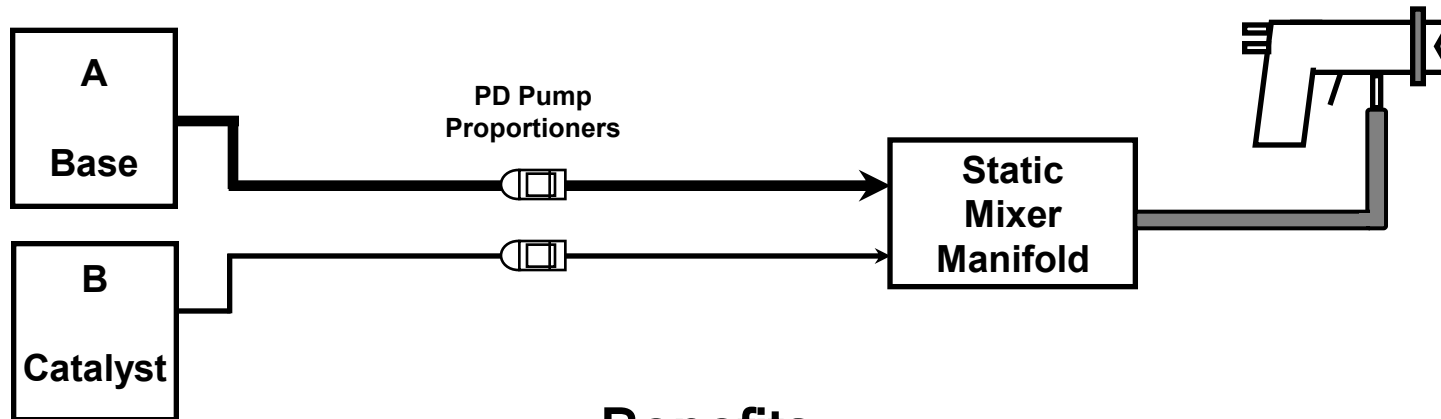
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# Continuous Application Method



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## Plural Component Spray



### Benefits

- Automated proportioning
- Precision mixing
- Utilizes HVLP spray guns
- Accommodates quick cure coating
- Minimizes waste material
- Minimizes cleanup waste and time

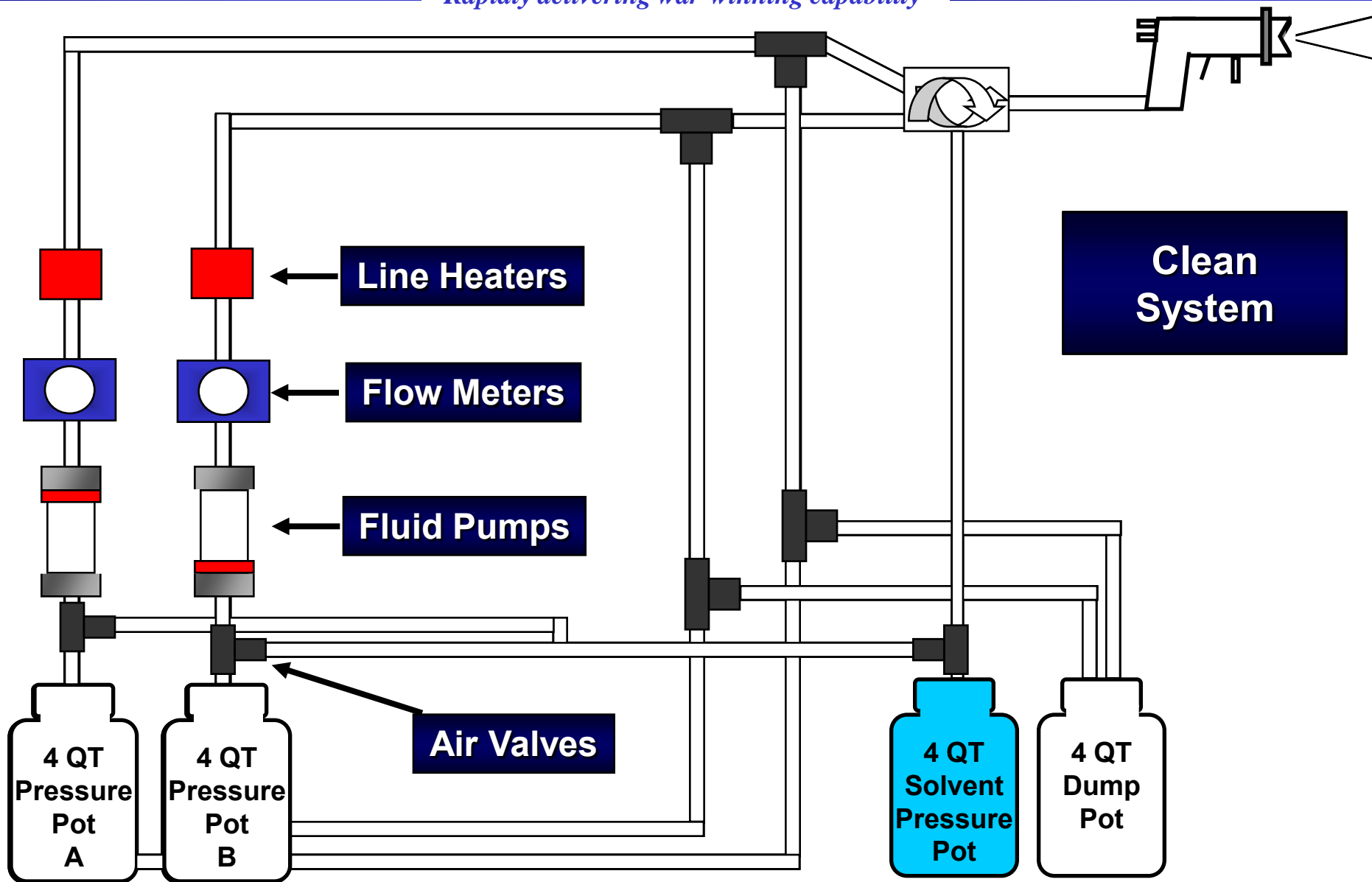


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# Detailed PCS Schematic

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# Methodology – Phase I

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- Candidate Evaluation
- Cost-Benefit Data
- Future Dem/Val

## **Phase II Activities**

### **Performance Testing**

- Comparison to baseline material
- Full properties testing & reformulation (*if needed*)
- Final candidate(s) recommendations (Maximum of 2)

### **Screening Testing**

- Comparison to baseline material
- Critical properties testing & reformulation (*if needed*)

### **Verification and Down-Selection**

- Verification of vendor claims
- Limited testing & reformulation (*if needed*)
- Selection of screening candidates (Maximum of 5)

### **Material Selection and Formulation**

- Industry survey of vendor products
- Evaluation against Raytheon criteria
- Selection of initial candidates

### **Test Plan Development**

- Outline of individual tests
- Candidate performance criteria
- Identify stakeholder concerns



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# Methodology – Phase II

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- Candidate Qualification
- Cost-Benefit Data
- Documentation

## ***Phase III Activities***

### ***Production Acceptance Testing***

- Production size batches
- Verification of product consistency
- Critical properties testing

### ***Full-Scale Demonstration***

- Comparison to baseline material
- Full-scale engineering structure
- Application & usage properties

### ***Demonstration Plan Development***

- Programmatic document for Phases II & III
- Coordination of project stakeholders
- Promote successful technology transition

## ***Phase I Activities***



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# Methodology – Phase III

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- Documentation
- Implementation

## ***Transition Activities***

- Present project results to engineering change boards
- Acquire government and contractor approvals
- Include PCS technology within all relevant QPLs and TOs

## ***Cost & Performance Report***

- Technology overview
- Cost and performance assessments
- Identification of implementation issues

## ***Final Report***

- Project overview
- Summary of test results
- Support documents

## ***Full-Scale Validation***

- Production spray equipment
- Optimization of critical application parameters
- Comparison to baseline material

## ***Phase II Activities***



# Demonstration Plan Development



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- **Consideration of**
  - Performance & application parameters
  - Barriers to implementation
  - Initial cost-benefit analysis
- **Guidance**
  - Full-scale demonstration (Phase II)
  - Production acceptance testing (Phases II & III)
  - Full-scale validation (Phase III)



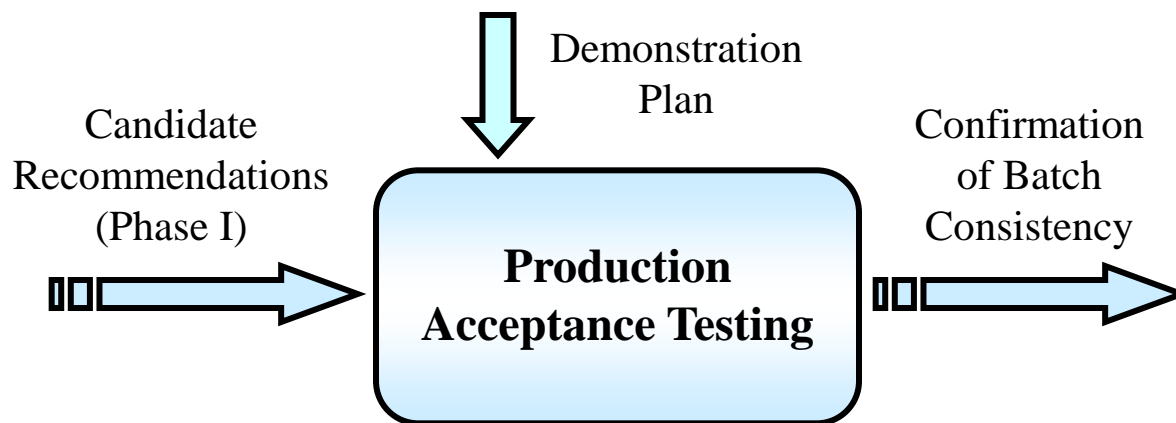


# Production Acceptance Testing



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- **Production Consistency**
  - Between batches
  - Within batches
- **Phase II**
  - Two production-sized batches
  - Two PCS candidates





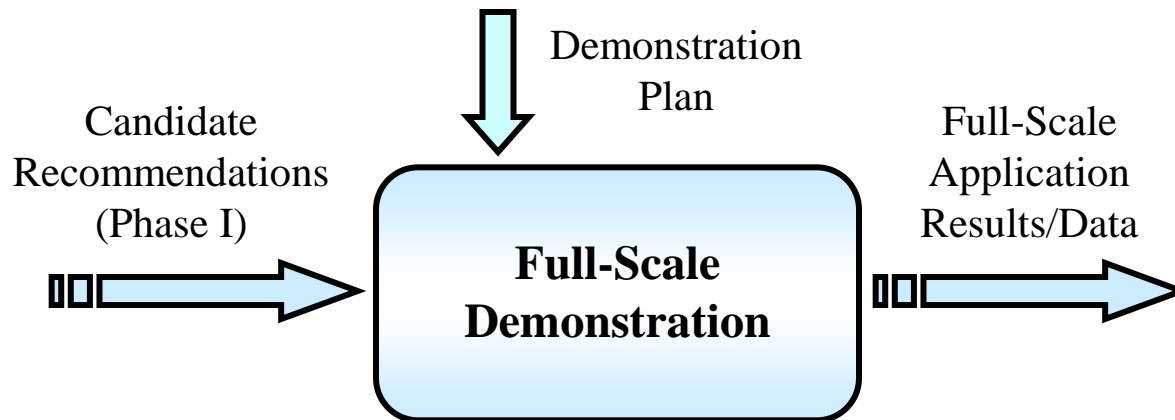
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# Full-Scale Demonstration

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- **Demonstration of application properties**
  - Spray-up engineering prototype/structure
  - Two PCS candidates & baseline
- **Compare**
  - Application performance
  - Cost metrics
  - Spray data/results





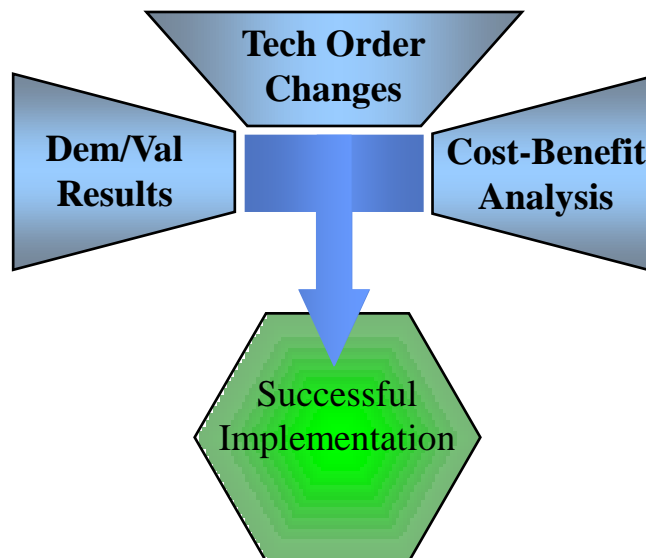
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# Follow-On Efforts

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- **Plan Full-Scale Validation**
  - Suggested Raytheon facility
  - Identify window of opportunity
- **Complete Data Collection**
  - Collect facility baseline & PCS cost data
  - Identify technology transition timeframe



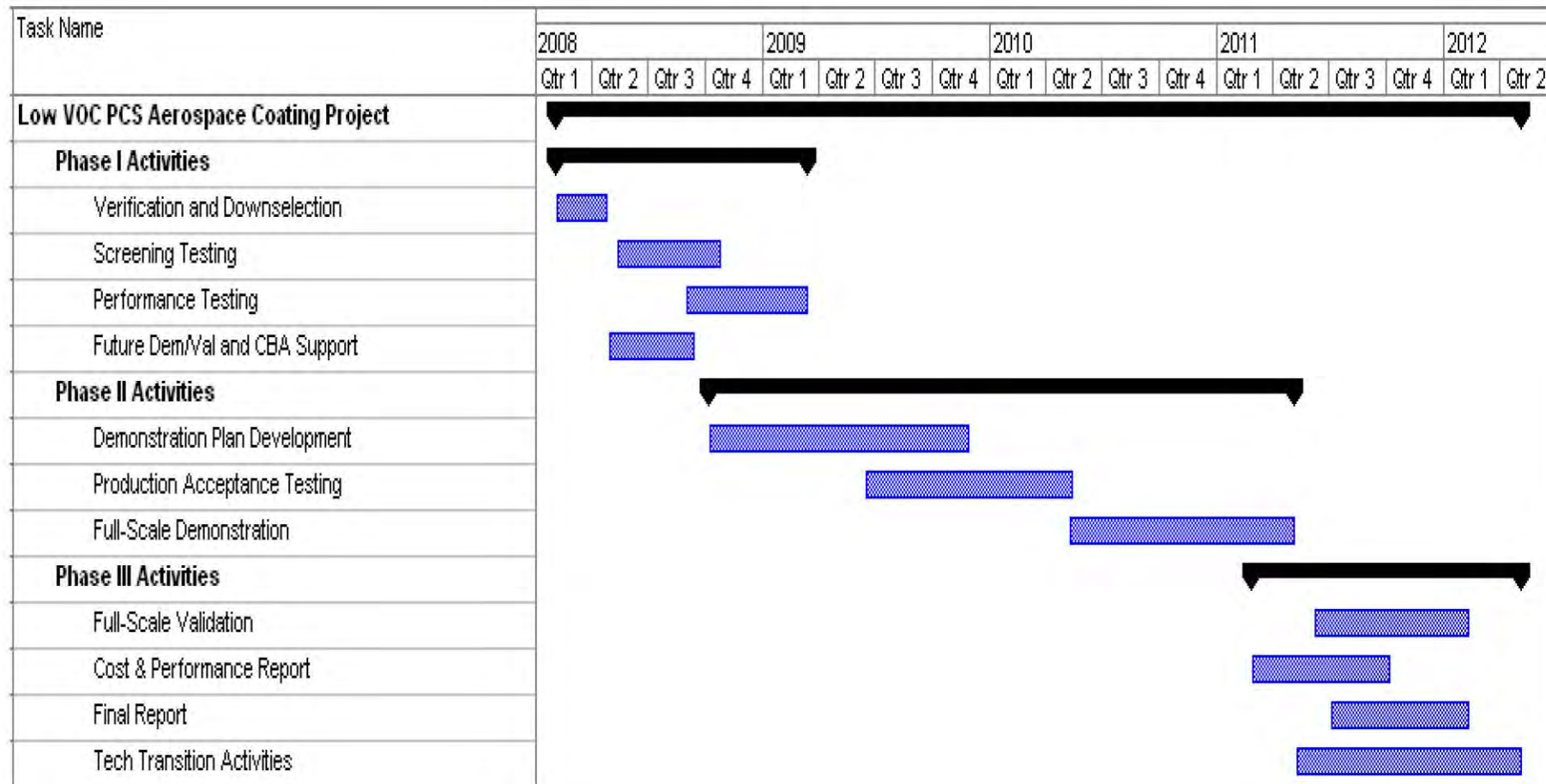


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# Task Plan



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# Program Organization Issues PCS Program Objectives Technical Approach **Technical Progress**



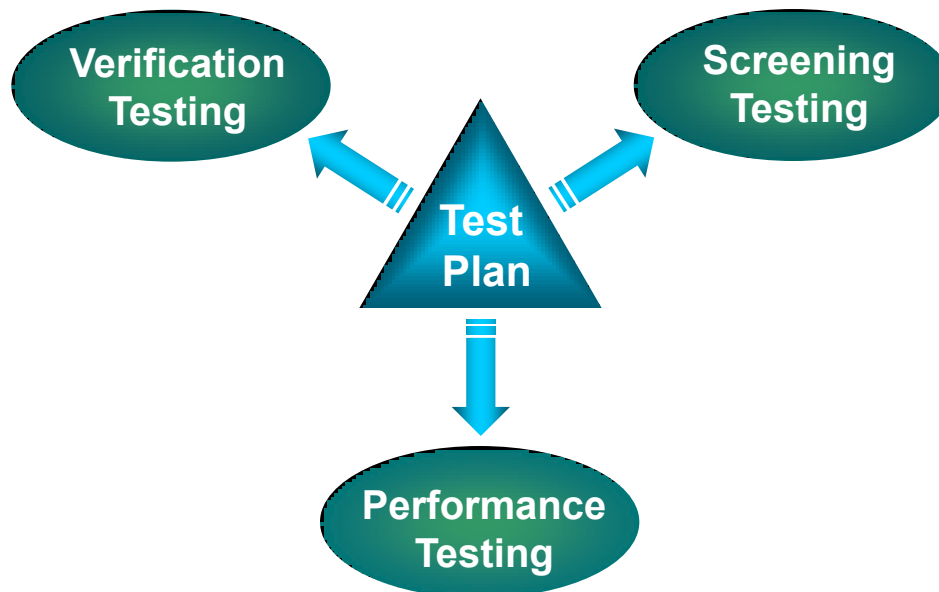
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# Test Plan Development

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- **Test Plan – Delivered**
  - Outlines all material testing by phase
  - Describes test procedures
  - Identifies associated pass/fail criteria
  - Documents test and control panel quantities



# Material Selection and Formulation

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- **MS&F – Completed**
  - Vendors submitted candidate coatings
  - Candidates identified
  - Transitioned to next stage





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# Verification and Down-Selection



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- **V&D – Completed**
  - Candidate materials procured
  - Spray evaluation completed
  - Limited testing accomplished
  - No product reformulations
  - All candidates demonstrated potential
  - Transitioned to next stage



# Screening & Performance Testing

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- **S&PT – Completed**
  - Candidate materials procured
  - Robust performance testing accomplished
  - No product reformulations
  - Recent down-selection decision
  - Two candidates move onto full-scale Phase II activities



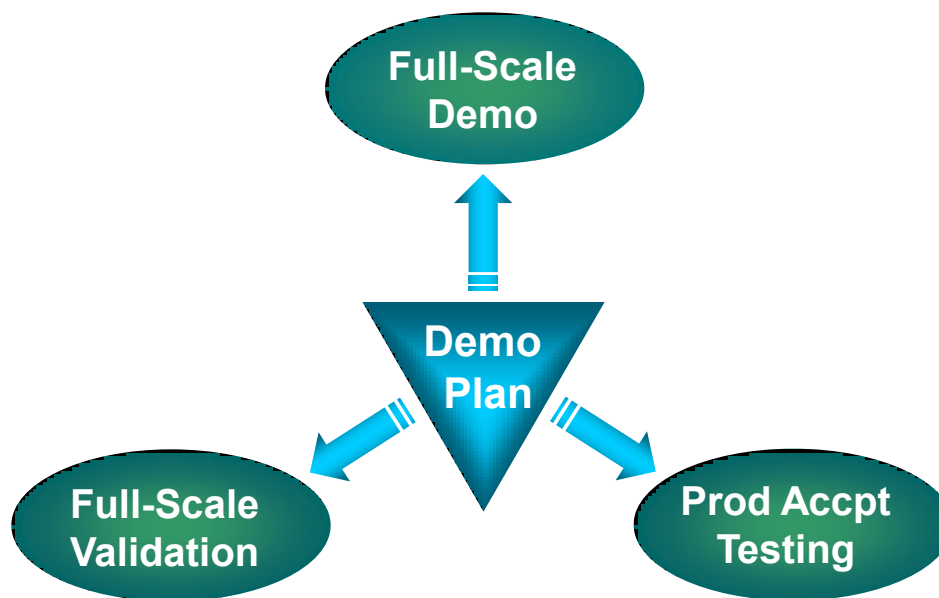


# Demo Plan Development



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- **Demonstration Plan – Draft Development**
  - Populating document with required information
  - Gathering inputs from stakeholders
  - Demo Plan approval projected for Q4 2009





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# Summary

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- **Current Aerospace Coatings Application Methods**
  - Batch mixed
  - Continuous (plural component spray)
- **PCS Program Goals**
  - Identify promising candidates
  - Confirm full-scale applicability
  - Qualify & implement PCS alternative
- **Expected Environmental Benefits of PCS Technology**
  - Reduced VOC content
  - Reduced overall application and cure times
  - Reduced hazardous waste generation
  - Reduced labor hours for clean-up
- **Status**
  - Candidate material test matrix identified
  - Candidate performance testing completed
  - Down-selection decision occurred (Phase I close-out)
  - Phase II activities beginning



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# Questions?





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